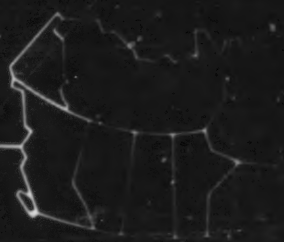
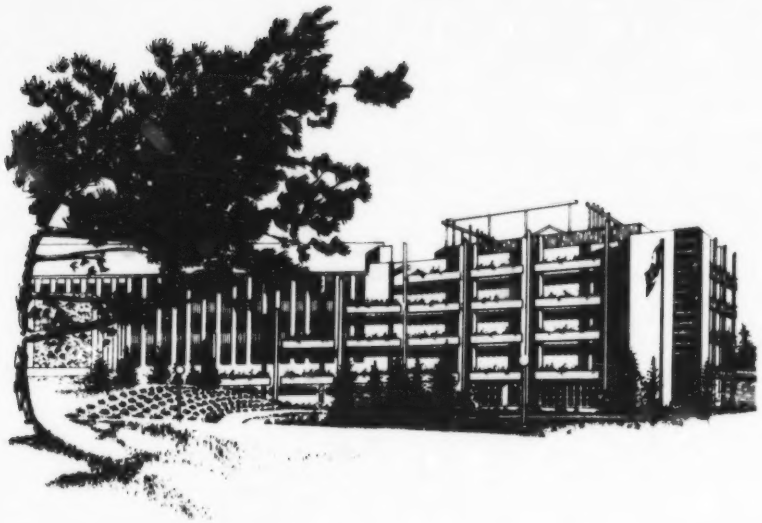
Site index equations for
black spruce and white spruce
in the Yukon





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Contents

Abstract/Résumé iv
Acknowledgements iv
Introduction 1
Data 1
Methods 1
Results and discussion 2
References 5
Appendix 19

Tables

1. Estimated values of a_0 and a_1 for decadel age classes in the regression $(S\text{-}1.3) = a_0 + a_1(H\text{-}1.3)$ for black spruce 6

2. Estimated values of a_0 and a_1 for decadel age classes in the regression $(S\text{-}1.3) = a_0 + a_1(H\text{-}1.3)$ for white spruce 6

3. Average heights in metres of dominant and codominant black spruce by breast height age and site 7

4. Average heights in metres of dominant and codominant white spruce by breast height age and site 13

Figures

1. Site index curves for black spruce in the Yukon 3

2. Site index curves for white spruce in the Yukon 4

Abstract

Site index equations are presented for black spruce (*Picea mariana* (Mill.) B.S.P.) and white spruce (*Picea glauca* (Moench) Voss.) for the Yukon Territory, Canada. The procedures employed follow the two-stage method of developing site index equations and curves from stem analysis data described in the literature. Linear regressions between site index and decadal height were used to develop candidate transformations and final variables were selected for the site index equations using stepwise linear regression techniques.

Résumé

Les auteurs présentent des équations d'indice de station pour l'épinette noire (*Picea mariana* (Mill.) B.S.P.) et l'épinette blanche (*Picea glauca* (Moench) Voss.) du Yukon, au Canada. Ils ont utilisé la méthode à deux niveaux pour élaborer les équations et les courbes d'indices de stations à partir des données d'analyse des tiges décrites dans la documentation. Ils ont eu recours aux régressions linéaires entre l'indice de station et la hauteur décennale pour élaborer des transformations éventuelles et ont sélectionné les variables finales pour les équations d'indice de station à l'aide de techniques de régression linéaire séquentielle.

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We would like to thank Dr. M.R.C. Massie for his assistance in providing information about the original plot selection and establishment and measurement of the sample trees.

Introduction

Site index curves contain essential information for the management of forest resources. The Department of Indian and Northern Affairs, Forest Resources Division (Yukon) is presently attempting to increase the level of forest management in the Yukon and requires site index curves for its three potentially commercial species: lodgepole pine (*Pinus contorta* Dougl.), white spruce (*Picea glauca* (Moench) Voss.), and black spruce (*Picea mariana* (Mill.) B.S.P.). Site index curves for lodgepole pine are available for the upper Liard River area of the Yukon in Alemdag (1971, 1976) and for south-central Yukon in Thompson *et al.* (1984). Prior to this study, site index curves for white spruce were available in Alemdag (1971, 1976) only for the upper Liard River area, and were not available for black spruce.

The Pacific and Yukon Region of Forestry Canada agreed to provide site index curves to the Forest Resources Division (Yukon) of Indian and Northern Affairs Canada. Forestry Canada had sampled a large number of tree boles of the three major species for another project in the Yukon. With the addition of stem analyses on the samples, these provided sufficient data on which to develop site index curves. The site index curves developed for lodgepole pine by Thompson *et al.* (1984) were based on these data.

Data

The data from which these site index curves were developed were obtained by Forestry Canada from stem analysis of field samples collected on 108 plots in the Yukon. The field samples were collected by Nawitka Resource Consultants Ltd., Victoria, British Columbia in 1983 as part of Forestry Canada's Energy from the Forests (ENFOR) program. Samples were taken in eight ecoregions (Oswald and Senyk 1977): 1, 2, 4, 5, 8, 9, 11, and 12 (an ecoregion map is given in the Appendix). The field data utilized consisted of sample tree height, diameter at breast height, tree number, plot number and ecoregion. Stem analysis data from later laboratory measurement at stump height (0.3 m) and diameter at breast height (1.3 m) and every 2 m thereafter for all dominant and codominant undamaged trees was also utilized.

Sample trees that were less than 50 years of age at breast height were excluded from the data set. The individual sample trees were examined to identify any trees which had been damaged or which had been severely suppressed and subsequently released. This was accomplished by plotting stem analysis height-over-age data for individual trees by ecoregion and examining height growth over time. As a result of this examination, two sample trees were discarded from the black spruce data set. In both cases the discarded trees had been suppressed for a considerable period of time and then released.

Methods

The procedures used to develop the site index curves in this report follow the two-stage method of developing site index equations and curves from stem analysis data as described by Dahms (1975), Monserud (1984), Goudie (1984), Alemdag (1988) and others. In this procedure, linear regressions between site index and decadal height were used to develop candidate transformations by relating site index to height, and final variables were selected for the site index equations using stepwise linear regression techniques.

Following the approach of Alemdag (1988), the site index (S) of each tree was determined from the estimate of total tree height (H) in metres at breast height age (BHA) of 50 years. Regression equations were fitted for (S-1.3) over (H-1.3) by 10-year age classes using the model:

$$(S-1.3) = a_0 + a_1(H-1.3) \qquad (1)$$

The estimated values of a_0 and a_1, (Tables 1 and 2), which have been shown to be dependent on age, were then fitted as a function of age. Similar relationships to those of Alemdag (1988) were found, i.e., the points fell along a polynomial of second or higher degree.

Following the terminology of Alemdag (1988), equation (1) can be reformulated as follows:

$$a_0 = b_1X + b_2X^2$$

$$a_1 = 1.0 + c_1Z + c_2Z^2$$

where: $X = BHA - 50$ or $X = \ln(BHA/50)$
and $Z = BHA - 50$ or $Z = \ln(BHA/50)$

Hence:

$$S = 1.3 + (b_1X+b_2X^2) + (1.0+c_1Z + c_2Z^2)(H-1.3) \qquad (2)$$

The results of the regression analyses based on Alemdag's transformations, as reflected by the values of R, indicated that the best estimation of site index for black spruce and white spruce would be achieved by using the following model:

$$(S-H) = b_1X + b_2X^2 + c_1(H-1.3)Z + c_2(H-1.3)Z^2 \qquad (3)$$

Analysis of the results generated by the site index equations based on equation (3) indicated that it consistently overestimated the higher sites at young ages. To reduce this bias, the approach developed by Monserud (1984) and modified by Goudie (1984) was tested. This model differs from that taken later by Alemdag (1988) in the form of the transformations.

The analyses indicated that the best estimation of site index, as reflected by the values of R, would be achieved using Goudie's transformations.

Results and Discussion

The black and white spruce data were fitted to equation 4 and the values of b and c were calculated using stepwise linear regression analyses.

The equations developed for black spruce (equation 5) and for white spruce (equation 6) were solved and site index curves and tables are shown in Figures 1 and 2 and Tables 3 and 4.

Use of the procedures employed by Alemdag (1988) for the derivation of site index equations for black and white spruce in the Northwest Territories allowed the relatively easy derivation of site index curves for black and white spruce in Yukon.

In comparing the equations developed by Alemdag (1988) for the Northwest Territories, the sets of equations for the two different territories are similar. The equations for estimating site index for both black and white spruce should not be applied beyond a breast height age of 150 years in order to remain within the data domain.

$$S = H + a\left(\frac{H}{BHA} - \frac{H}{50}\right) - b\left(\frac{1}{BHA} - \frac{1}{50}\right) + c\left(\frac{\ln BHA}{BHA} - \frac{\ln 50}{50}\right) \quad (4)$$

Black spruce

$$S = H + 35.5057\left(\frac{H}{BHA} - \frac{H}{50}\right) - 52.3049\left(\frac{1}{BHA} - \frac{1}{50}\right) + 10.026\left(\frac{\ln BHA}{BHA} - \frac{\ln 50}{50}\right) \quad (5)$$

$$(R^2 = 0.9251 \quad N = 3703)$$

White spruce

$$S = H + 38.037\left(\frac{H}{BHA} - \frac{H}{50}\right) - 60.5757\left(\frac{1}{BHA} - \frac{1}{50}\right) + 22.0755\left(\frac{\ln BHA}{BHA} - \frac{\ln 50}{50}\right) \quad (6)$$

$$(R^2 = 0.9433 \quad N = 4227)$$

where:
S = site index
H = total height (m)
BHA = age above breast height

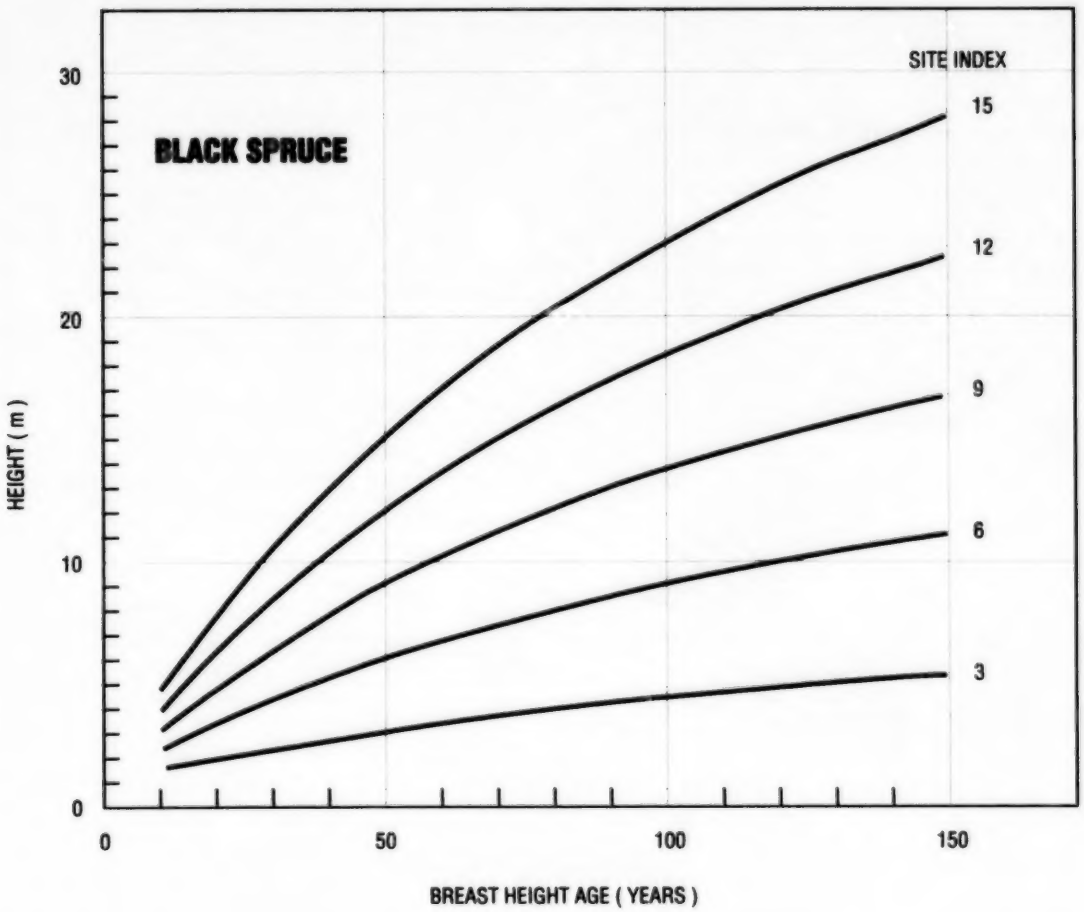

Figure 1. Site index curves for black spruce in the Yukon

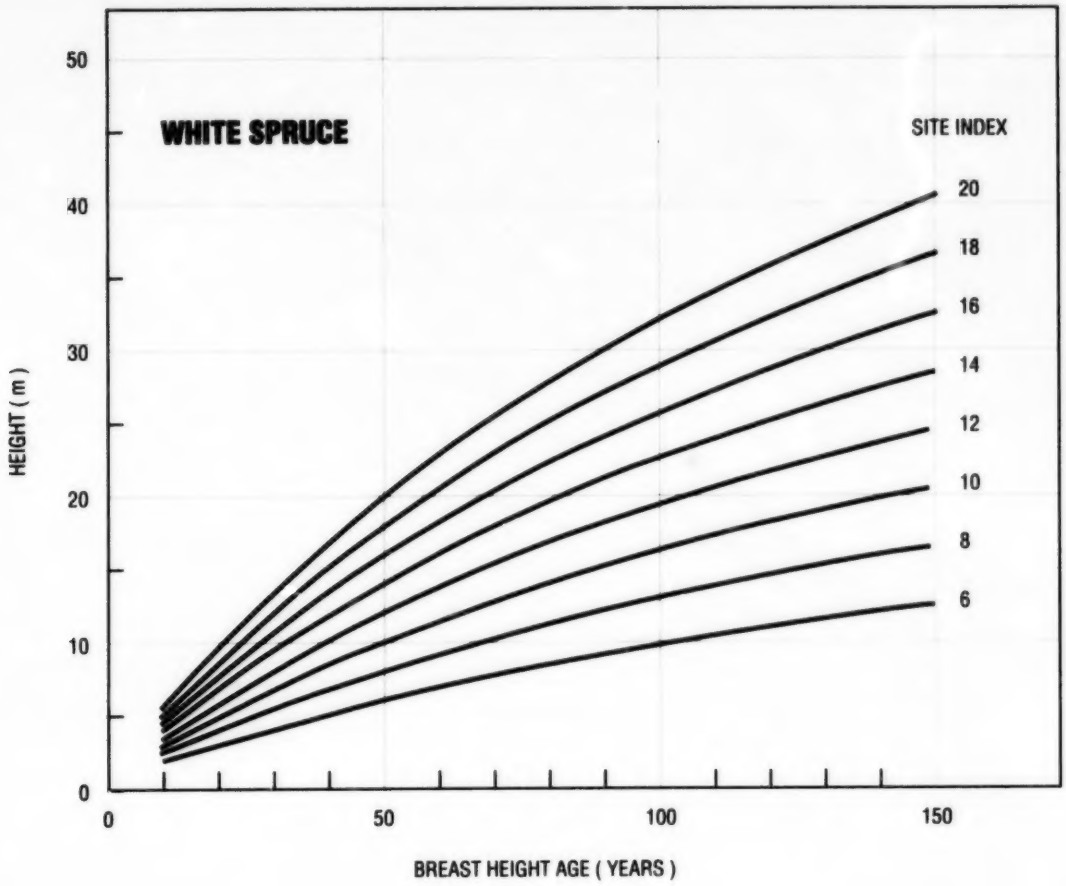

Figure 2. Site index curves for white spruce in the Yukon

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Table 1. Estimated values of a_0 and a_1 for decadal age classes in the regression $(S\text{-}1.3)=a_0+a_1\,(H\text{-}1.3)$ for black spruce

Breast height age	Sample size	a_0	a_1	R^2
10	152	1.91087	3.11743	0.5976
20	152	1.40397	1.78743	0.7445
30	152	0.85593	1.33729	0.8972
40	152	0.37303	1.12949	0.9731
50	152	0.00000	1.00000	1.0000
60	148	-0.13898	0.88514	0.9707
70	146	-0.11545	0.78523	0.9317
80	137	-0.10521	0.72282	0.8955
90	128	-0.12182	0.68075	0.8632
100	115	-0.26951	0.65488	0.8425
110	93	-0.34296	0.63640	0.8304
120	66	-0.22860	0.56465	0.7370
130	59	-0.18227	0.52954	0.7119
140	46	-0.13745	0.48208	0.6668
150	34	0.26833	0.41422	0.5860

Table 2. Estimated values of a_0 and a_1 for decadal age classes in the regression $(S\text{-}1.3)=a_0+a_1\,(H\text{-}1.3)$ for white spruce

Breast height age	Sample size	a_0	a_1	R^2
10	178	3.34199	3.39625	0.6733
20	178	2.45410	1.92052	0.7771
30	178	1.60998	1.39786	0.8935
40	178	0.72675	1.14545	0.9741
50	178	0.00000	1.00000	1.0000
60	169	-0.57324	0.90171	0.9763
70	157	-1.01230	0.82667	0.9229
80	145	-1.17074	0.75473	0.8671
90	116	-0.67189	0.64694	0.8010
100	92	-0.39232	0.57388	0.7438
110	79	-0.10546	0.52242	0.6875
120	67	0.45809	0.45160	0.6126
130	57	0.41591	0.43407	0.6157
140	52	0.43843	0.41671	0.6140
150	41	-0.44204	0.46933	0.7346

Table 3. Average heights in metres of dominant and codominant black spruce by breast height age and site

Breast height age (Years)	Site Index 2	3	4	5	6	7	8
10	1.22	1.48	1.74	2.00	2.26	2.52	2.78
11	1.23	1.51	1.79	2.08	2.37	2.65	2.94
12	1.24	1.55	1.85	2.17	2.47	2.78	3.08
13	1.25	1.58	1.92	2.25	2.58	2.91	3.24
14	1.27	1.63	1.98	2.33	2.69	3.04	3.40
15	1.29	1.67	2.04	2.42	2.79	3.17	3.54
16	1.30	1.71	2.10	2.50	2.90	3.30	3.69
17	1.32	1.75	2.17	2.58	3.00	3.42	3.85
18	1.34	1.78	2.23	2.67	3.11	3.56	4.00
19	1.36	1.82	2.29	2.75	3.21	3.68	4.14
20	1.39	1.87	2.35	2.83	3.32	3.81	4.29
21	1.41	1.91	2.42	2.92	3.42	3.93	4.43
22	1.43	1.95	2.48	3.00	3.52	4.05	4.58
23	1.45	1.99	2.54	3.08	3.63	4.17	4.72
24	1.47	2.03	2.60	3.16	3.73	4.29	4.86
25	1.49	2.07	2.65	3.24	3.83	4.41	5.00
26	1.51	2.12	2.71	3.32	3.92	4.53	5.13
27	1.53	2.15	2.77	3.40	4.02	4.64	5.27
28	1.55	2.19	2.83	3.48	4.12	4.76	5.41
29	1.57	2.23	2.90	3.56	4.21	4.88	5.54
30	1.59	2.27	2.95	3.63	4.31	4.99	5.67
31	1.61	2.31	3.01	3.71	4.40	5.10	5.79
32	1.64	2.35	3.06	3.78	4.50	5.21	5.92
33	1.66	2.39	3.12	3.85	4.58	5.32	6.05
34	1.68	2.43	3.18	3.93	4.67	5.42	6.17
35	1.70	2.46	3.23	4.00	4.76	5.54	6.30
36	1.72	2.50	3.29	4.07	4.86	5.64	6.42
37	1.74	2.54	3.35	4.14	4.95	5.75	6.54
38	1.76	2.58	3.40	4.21	5.03	5.84	6.67
39	1.78	2.62	3.45	4.29	5.12	5.95	6.78
40	1.80	2.65	3.50	4.35	5.20	6.05	6.90
41	1.82	2.69	3.56	4.42	5.29	6.15	7.01
42	1.84	2.73	3.60	4.49	5.37	6.25	7.13
43	1.86	2.76	3.66	4.55	5.45	6.34	7.25
44	1.89	2.79	3.71	4.62	5.53	6.45	7.36
45	1.91	2.83	3.76	4.68	5.61	6.54	7.46
46	1.93	2.87	3.81	4.75	5.69	6.63	7.58
47	1.95	2.90	3.86	4.82	5.77	6.73	7.68
48	1.97	2.94	3.90	4.88	5.85	6.82	7.79
49	1.99	2.97	3.96	4.94	5.92	6.91	7.90

Table 3. (continued) Average heights in metres of dominant and codominant black spruce by breast height age and site

Breast height age (Years)	Site Index 9	10	11	12	13	14	15
10	3.04	3.30	3.56	3.82	4.08	4.34	4.60
11	3.21	3.50	3.79	4.07	4.36	4.64	4.92
12	3.40	3.71	4.01	4.32	4.63	4.93	5.24
13	3.57	3.90	4.24	4.57	4.89	5.22	5.56
14	3.75	4.10	4.46	4.81	5.17	5.51	5.87
15	3.92	4.30	4.67	5.05	5.43	5.80	6.18
16	4.09	4.50	4.89	5.29	5.69	6.09	6.49
17	4.27	4.69	5.11	5.53	5.95	6.37	6.79
18	4.44	4.88	5.32	5.76	6.21	6.65	7.09
19	4.61	5.07	5.54	6.00	6.46	6.92	7.38
20	4.78	5.25	5.74	6.22	6.71	7.20	7.68
21	4.94	5.45	5.95	6.46	6.96	7.46	7.96
22	5.10	5.63	6.15	6.67	7.20	7.73	8.26
23	5.26	5.81	6.36	6.90	7.45	7.99	8.54
24	5.42	5.99	6.55	7.12	7.68	8.25	8.81
25	5.58	6.17	6.75	7.33	7.92	8.51	9.09
26	5.74	6.34	6.95	7.55	8.15	8.76	9.36
27	5.89	6.51	7.14	7.76	8.38	9.01	9.63
28	6.04	6.68	7.33	7.97	8.61	9.26	9.89
29	6.20	6.86	7.51	8.18	8.84	9.50	10.16
30	6.34	7.03	7.70	8.38	9.06	9.74	10.41
31	6.50	7.19	7.88	8.59	9.28	9.97	10.68
32	6.64	7.36	8.07	8.78	9.49	10.21	10.93
33	6.79	7.51	8.24	8.98	9.71	10.45	11.18
34	6.92	7.67	8.43	9.18	9.93	10.68	11.43
35	7.07	7.83	8.60	9.37	10.13	10.90	11.66
36	7.21	7.99	8.78	9.55	10.34	11.13	11.91
37	7.34	8.14	8.95	9.74	10.54	11.35	12.14
38	7.48	8.29	9.12	9.93	10.75	11.56	12.38
39	7.62	8.45	9.28	10.12	10.95	11.78	12.62
40	7.75	8.60	9.45	10.29	11.14	11.99	12.85
41	7.88	8.74	9.61	10.47	11.34	12.21	13.07
42	8.01	8.89	9.77	10.65	11.54	12.41	13.29
43	8.14	9.04	9.93	10.83	11.72	12.62	13.52
44	8.27	9.18	10.09	11.00	11.91	12.82	13.73
45	8.39	9.32	10.24	11.18	12.10	13.03	13.96
46	8.52	9.46	10.40	11.35	12.29	13.22	14.17
47	8.64	9.60	10.55	11.51	12.46	13.43	14.38
48	8.77	9.73	10.71	11.68	12.65	13.62	14.59
49	8.88	9.87	10.86	11.84	12.82	13.81	14.80

Table 3. (continued) Average heights in metres of dominant and codominant black spruce by breast height age and site

Breast height age: (Years)	Site Index 2	3	4	5	6	7	8
50	2.00	3.00	4.00	5.00	6.00	7.00	8.01
51	2.02	3.04	4.05	5.07	6.08	7.09	8.11
52	2.04	3.07	4.09	5.13	6.16	7.18	8.21
53	2.06	3.10	4.14	5.18	6.22	7.27	8.31
54	2.08	3.13	4.19	5.25	6.30	7.36	8.41
55	2.10	3.17	4.24	5.30	6.38	7.44	8.51
56	2.12	3.19	4.28	5.36	6.45	7.53	8.61
57	2.13	3.23	4.33	5.42	6.51	7.61	8.71
58	2.15	3.26	4.37	5.47	6.58	7.70	8.80
59	2.17	3.29	4.41	5.54	6.66	7.78	8.90
60	2.19	3.32	4.46	5.59	6.72	7.86	8.99
61	2.21	3.35	4.50	5.64	6.79	7.94	9.09
62	2.22	3.38	4.54	5.70	6.86	8.02	9.18
63	2.24	3.41	4.58	5.75	6.92	8.10	9.27
64	2.25	3.44	4.63	5.81	6.99	8.18	9.36
65	2.27	3.47	4.67	5.86	7.06	8.26	9.45
66	2.29	3.50	4.71	5.92	7.13	8.33	9.54
67	2.31	3.52	4.75	5.96	7.18	8.40	9.63
68	2.33	3.56	4.79	6.02	7.25	8.48	9.71
69	2.34	3.58	4.83	6.07	7.32	8.55	9.80
70	2.35	3.61	4.87	6.12	7.38	8.63	9.88
71	2.38	3.64	4.91	6.17	7.43	8.71	9.97
72	2.39	3.67	4.95	6.22	7.50	8.78	10.05
73	2.40	3.69	4.98	6.27	7.56	8.85	10.13
74	2.42	3.72	5.02	6.32	7.62	8.92	10.21
75	2.44	3.75	5.06	6.37	7.68	8.99	10.30
76	2.46	3.77	5.09	6.42	7.74	9.06	10.38
77	2.47	3.80	5.13	6.46	7.79	9.13	10.46
78	2.48	3.83	5.17	6.51	7.85	9.20	10.54
79	2.50	3.85	5.21	6.55	7.91	9.26	10.62
80	2.52	3.88	5.24	6.61	7.96	9.33	10.69
81	2.53	3.90	5.28	6.65	8.02	9.39	10.77
82	2.54	3.93	5.31	6.70	8.08	9.46	10.85
83	2.56	3.95	5.34	6.74	8.13	9.53	10.92
84	2.58	3.98	5.38	6.79	8.19	9.59	10.99
85	2.59	4.00	5.42	6.83	8.24	9.65	11.07
86	2.60	4.03	5.45	6.87	8.29	9.72	11.14
87	2.62	4.05	5.48	6.92	8.35	9.78	11.21
88	2.63	4.08	5.51	6.96	8.40	9.84	11.29
89	2.65	4.09	5.55	7.00	8.45	9.90	11.36
90	2.66	4.12	5.58	7.04	8.51	9.96	11.43
91	2.67	4.14	5.62	7.08	8.55	10.03	11.49
92	2.69	4.17	5.64	7.13	8.61	10.09	11.56
93	2.70	4.19	5.68	7.17	8.65	10.14	11.63
94	2.71	4.21	5.71	7.21	8.71	10.21	11.70
95	2.73	4.24	5.74	7.25	8.76	10.26	11.77
96	2.74	4.25	5.77	7.29	8.80	10.32	11.84
97	2.75	4.28	5.80	7.33	8.85	10.38	11.90
98	2.77	4.30	5.83	7.37	8.90	10.44	11.96
99	2.78	4.32	5.87	7.41	8.95	10.49	12.03

Table 3. (continued) Average heights in metres of dominant and codominant black spruce by breast height age and site

Breast height age (Years)	Site Index 9	10	11	12	13	14	15
50	9.01	10.01	11.01	12.01	13.01	14.01	15.01
51	9.12	10.13	11.15	12.16	13.18	14.19	15.21
52	9.23	10.27	11.29	12.32	13.35	14.38	15.40
53	9.35	10.39	11.44	12.48	13.52	14.56	15.61
54	9.46	10.52	11.58	12.63	13.69	14.74	15.80
55	9.58	10.65	11.72	12.79	13.86	14.93	15.99
56	9.69	10.78	11.86	12.94	14.02	15.11	16.18
57	9.80	10.89	11.99	13.09	14.19	15.28	16.38
58	9.91	11.02	12.13	13.23	14.35	15.46	16.57
59	10.02	11.14	12.26	13.38	14.51	15.63	16.75
60	10.13	11.26	12.39	13.53	14.66	15.80	16.93
61	10.23	11.38	12.53	13.68	14.82	15.96	17.11
62	10.34	11.49	12.65	13.81	14.97	16.14	17.30
63	10.44	11.62	12.79	13.96	15.13	16.30	17.47
64	10.54	11.73	12.91	14.10	15.28	16.46	17.65
65	10.64	11.84	13.04	14.23	15.43	16.63	17.82
66	10.74	11.96	13.16	14.37	15.58	16.79	18.00
67	10.85	12.06	13.29	14.51	15.72	16.95	18.16
68	10.95	12.18	13.41	14.64	15.87	17.10	18.34
69	11.04	12.29	13.53	14.77	16.02	17.26	18.50
70	11.14	12.39	13.65	14.90	16.16	17.41	18.66
71	11.23	12.50	13.77	15.03	16.30	17.57	18.83
72	11.33	12.61	13.88	15.16	16.44	17.71	18.99
73	11.43	12.71	14.00	15.29	16.57	17.86	19.16
74	11.52	12.81	14.12	15.41	16.71	18.01	19.31
75	11.61	12.92	14.23	15.54	16.85	18.16	19.47
76	11.70	13.02	14.34	15.66	16.98	18.30	19.63
77	11.79	13.12	14.46	15.79	17.11	18.45	19.78
78	11.88	13.22	14.56	15.90	17.25	18.59	19.93
79	11.96	13.32	14.67	16.02	17.38	18.73	20.09
80	12.05	13.42	14.78	16.14	17.50	18.87	20.23
81	12.14	13.52	14.89	16.26	17.64	19.01	20.38
82	12.23	13.61	14.99	16.38	17.76	19.14	20.53
83	12.31	13.71	15.10	16.50	17.89	19.28	20.68
84	12.39	13.80	15.21	16.61	18.01	19.41	20.82
85	12.48	13.89	15.30	16.72	18.14	19.55	20.96
86	12.56	13.98	15.41	16.84	18.25	19.68	21.10
87	12.64	14.08	15.51	16.95	18.38	19.81	21.24
88	12.72	14.17	15.61	17.05	18.50	19.94	21.38
89	12.80	14.26	15.71	17.16	18.61	20.07	21.52
90	12.88	14.35	15.81	17.27	18.73	20.20	21.66
91	12.96	14.44	15.90	17.38	18.85	20.32	21.79
92	13.04	14.53	16.00	17.48	18.96	20.45	21.93
93	13.12	14.61	16.10	17.59	19.08	20.57	22.05
94	13.20	14.70	16.20	17.70	19.19	20.69	22.18
95	13.28	14.78	16.29	17.80	19.30	20.81	22.32
96	13.35	14.87	16.39	17.90	19.41	20.93	22.45
97	13.43	14.95	16.48	18.00	19.52	21.05	22.57
98	13.50	15.04	16.57	18.10	19.64	21.26	22.70
99	13.57	15.12	16.66	18.20	19.74	21.29	22.82

Table 3. (continued) Average heights in metres of dominant and codominant black spruce by breast height age and site

Breast height age (Years)	Site Index 2	3	4	5	6	7	8
100	2.79	4.34	5.89	7.45	8.99	10.54	12.10
101	2.81	4.37	5.92	7.49	9.04	10.60	12.16
102	2.82	4.38	5.96	7.52	9.09	10.65	12.22
103	2.83	4.41	5.99	7.56	9.13	10.71	12.29
104	2.85	4.43	6.01	7.59	9.18	10.77	12.35
105	2.85	4.45	6.04	7.63	9.22	10.81	12.41
106	2.87	4.47	6.07	7.67	9.27	10.87	12.47
107	2.88	4.49	6.09	7.71	9.31	10.93	12.53
108	2.90	4.51	6.13	7.74	9.36	10.97	12.59
109	2.90	4.53	6.16	7.78	9.40	11 03	12.65
110	2.92	4.55	6.18	7.82	9.45	11.08	12.71
111	2.93	4.57	6.21	7.85	9.49	11.13	12.77
112	2.94	4.59	6.24	7.88	9.53	11.18	12.82
113	2.95	4.61	6.26	7.92	9.57	11.23	12.88
114	2.96	4.63	6.29	7.95	9.62	11.28	12.94
115	2.98	4.64	6.32	7.99	9.65	11.32	13.00
116	2.98	4.67	6.34	8.02	9.70	11.38	13.05
117	3.00	4.68	6.37	8.05	9.74	11.43	13.11
118	3.01	4.70	6.39	8.09	9.78	11.47	13.16
119	3.02	4.72	6.42	8.12	9.82	11.52	13.22
120	3.03	4.74	6.45	8.15	9.86	11.56	13.28
121	3.04	4.75	6.47	8.19	9.90	11.62	13.33
122	3.06	4.78	6.50	8.22	9.94	11.66	13.38
123	3.06	4.79	6.52	8.25	9.98	11.71	13.44
124	3.08	4.81	6.54	8.28	10.02	11.75	13.49
125	3.08	4.83	6.57	8.31	10.05	11.79	13.54
126	3.10	4.84	6.59	8.35	10.10	11.84	13.59
127	3.10	4.87	6.62	8.38	10.13	11.88	13.64
128	3.12	4.88	6.64	8.40	10.17	11.93	13.70
129	3.13	4.89	6.67	8.44	10.21	11.97	13.74
130	3.14	4.92	6.69	8.46	10.24	12.02	13.79
131	3.15	4.93	6.71	8.49	10.28	12.06	13.85
132	3.16	4.95	6.74	8.53	10.31	12.11	13.89
133	3.17	4.96	6.76	8.55	10.35	12.15	13.95
134	3.18	4.98	6.79	8.59	10.39	12.19	13.99
135	3.19	5.00	6.80	8.62	10.43	12.23	14.04
136	3.20	5.01	6.83	8.64	10.46	12.28	14.09
137	3.21	5.03	6.85	8.67	10.49	12.31	14.13
138	3.22	5.04	6.88	8.70	10.53	12.36	14.19
139	3.23	5.06	6.89	8.73	10.56	12.39	14.23
140	3.23	5.08	6.92	8.76	10.60	12.44	14.28
141	3.25	5.09	6.94	8.79	10.63	12.47	14.32
142	3.25	5.11	6.96	8.81	10.66	12.52	14.37
143	3.27	5.13	6.98	8.84	10.70	12.55	14.41
144	3.27	5.14	7.00	8.87	10.73	12.60	14.46
145	3.29	5.16	7.03	8.89	10.77	12.63	14.51
146	3.29	5.17	7.04	8.92	10.79	12.68	14.55
147	3.31	5.18	7.07	8.95	10.83	12.71	14.60
148	3.31	5.20	7.08	8.97	10.86	12.75	14.63
149	3.32	5.21	7.11	9.00	10.89	12.79	14.68
150	3.33	5.23	7.13	9.03	10.93	12.82	14.72

Table 3. (continued) Average heights in metres of dominant and codominant black spruce by breast height age and site

Breast height age (Years)	Site Index 9	10	11	12	13	14	15
100	13.64	15.20	16.75	18.30	19.85	21.40	22.95
101	13.72	15.28	16.84	18.39	19.95	21.52	23.07
102	13.79	15.36	16.93	18.50	20.06	21.63	23.20
103	13.86	15.44	17.02	18.59	20.16	21.74	23.32
104	13.93	15.52	17.10	18.68	20.27	21.85	23.43
105	14.00	15.60	17.18	18.78	20.37	21.96	23.55
106	14.07	15.67	17.27	18.87	20.48	22.07	23.68
107	14.14	15.75	17.36	18.96	20.57	22.18	23.79
108	14.21	15.82	17.44	19.05	20.68	22.29	23.91
109	14.28	15.90	17.52	19.15	20.77	22.39	24.02
110	14.34	15.97	17.61	19.24	20.87	22.50	24.14
111	14.41	16.05	17.69	19.33	20.97	22.61	24.25
112	14.47	16.12	17.77	19.41	21.07	22.71	24.36
113	14.54	16.20	17.85	19.50	21.16	22.82	24.47
114	14.61	16.27	17.93	19.59	21.25	22.92	24.58
115	14.67	16.34	18.01	19.68	21.35	23.02	24.69
116	14.73	16.41	18.09	19.77	21.45	23.12	24.80
117	14.79	16.48	18.16	19.85	21.54	23.22	24.91
118	14.86	16.55	18.25	19.93	21.63	23.32	25.02
119	14.92	16.62	18.32	20.02	21.72	23.42	25.12
120	14.98	16.69	18.39	20.11	21.81	23.52	25.23
121	15.04	16.75	18.47	20.18	21.90	23.61	25.33
122	15.11	16.82	18.55	20.27	21.99	23.71	25.43
123	15.16	16.89	18.62	20.35	22.07	23.80	25.54
124	15.22	16.96	18.70	20.43	22.16	23.90	25.64
125	15.28	17.02	18.77	20.51	22.25	24.00	25.73
126	15.34	17.09	18.84	20.59	22.34	24.09	25.84
127	15.40	17.16	18.91	20.66	22.43	24.18	25.93
128	15.46	17.22	18.98	20.75	22.51	24.27	26.04
129	15.52	17.29	19.05	20.82	22.59	24.36	26.13
130	15.57	17.34	19.13	20.90	22.68	24.45	26.23
131	15.63	17.41	19.20	20.98	22.76	24.54	26.32
132	15.69	17.48	19.26	21.05	22.84	24.63	26.42
133	15.74	17.54	19.33	21.13	22.93	24.72	26.52
134	15.79	17.59	19.40	21.20	23.00	24.80	26.61
135	15.85	17.66	19.46	21.27	23.09	24.89	26.70
136	15.90	17.72	19.54	21.35	23.16	24.98	26.80
137	15.96	17.78	19.60	21.42	23.25	25.07	26.89
138	16.01	17.84	19.66	21.50	23.32	25.15	26.98
139	16.07	17.90	19.73	21.57	23.40	25.23	27.07
140	16.11	17.95	19.80	21.64	23.48	25.32	27.16
141	16.17	18.02	19.86	21.70	23.55	25.40	27.25
142	16.22	18.07	19.93	21.77	23.63	25.48	27.34
143	16.27	18.13	19.99	21.84	23.70	25.57	27.42
144	16.32	18.19	20.05	21.91	23.78	25.64	27.51
145	16.38	18.25	20.11	21.98	23.86	25.73	27.59
146	16.43	18.30	20.18	22.05	23.93	25.80	27.68
147	16.48	18.36	20.24	22.12	24.00	25.89	27.77
148	16.52	18.41	20.30	22.18	24.07	25.96	27.85
149	16.57	18.46	20.36	22.25	24.14	26.04	27.93
150	16.63	18.52	20.42	22.32	24.22	26.12	28.02

Table 4. Average heights in metres of dominant and codominant white spruce by breast height age and site

Breast height age (Years)	Site Index 6	7	8	9	10	11	12
10	1.85	2.10	2.35	2.60	2.85	3.09	3.34
11	1.96	2.23	2.50	2.77	3.04	3.31	3.58
12	2.06	2.35	2.64	2.94	3.23	3.52	3.81
13	2.15	2.48	2.79	3.10	3.42	3.73	4.05
14	2.27	2.60	2.94	3.27	3.62	3.96	4.29
15	2.37	2.73	3.09	3.45	3.81	4.17	4.53
16	2.48	2.86	3.24	3.63	4.00	4.39	4.77
17	2.58	2.99	3.40	3.80	4.20	4.61	5.01
18	2.69	3.12	3.54	3.97	4.39	4.82	5.25
19	2.81	3.25	3.70	4.14	4.59	5.04	5.49
20	2.92	3.38	3.85	4.32	4.79	5.25	5.72
21	3.02	3.52	4.00	4.49	4.97	5.46	5.95
22	3.13	3.65	4.15	4.66	5.17	5.67	6.18
23	3.25	3.77	4.30	4.83	5.36	5.88	6.42
24	3.35	3.90	4.45	5.00	5.55	6.09	6.64
25	3.46	4.04	4.60	5.17	5.74	6.30	6.88
26	3.58	4.16	4.75	5.33	5.92	6.51	7.10
27	3.68	4.29	4.89	5.50	6.11	6.71	7.33
28	3.79	4.42	5.04	5.67	6.29	6.92	7.54
29	3.90	4.54	5.18	5.83	6.47	7.12	7.76
30	4.00	4.67	5.33	6.00	6.66	7.32	7.99
31	4.11	4.79	5.47	6.16	6.84	7.52	8.21
32	4.21	4.92	5.62	6.32	7.02	7.72	8.42
33	4.32	5.04	5.76	6.47	7.20	7.92	8.63
34	4.42	5.17	5.90	6.63	7.37	8.11	8.85
35	4.53	5.29	6.04	6.79	7.54	8.30	9.05
36	4.63	5.41	6.17	6.95	7.72	8.49	9.27
37	4.74	5.53	6.32	7.11	7.89	8.68	9.47
38	4.84	5.64	6.45	7.25	8.06	8.87	9.68
39	4.94	5.76	6.58	7.41	8.23	9.05	9.88
40	5.04	5.88	6.72	7.56	8.40	9.24	10.08
41	5.14	6.00	6.85	7.71	8.56	9.43	10.28
42	5.24	6.11	6.99	7.86	8.73	9.61	10.48
43	5.33	6.22	7.12	8.01	8.89	9.79	10.68
44	5.43	6.34	7.25	8.15	9.05	9.96	10.87
45	5.53	6.45	7.38	8.29	9.22	10.14	11.06
46	5.63	6.57	7.50	8.44	9.38	10.31	11.26
47	5.72	6.67	7.63	8.58	9.54	10.49	11.45
48	5.82	6.79	7.75	8.72	9.70	10.66	11.63
49	5.91	6.89	7.88	8.87	9.85	10.84	11.82

Table 4. (continued) Average heights in metres of dominant and codominant white spruce by breast height age and site

Breast height age (Years)	Site Index 13	14	15	16	17	18	19	20
10	3.58	3.83	4.08	4.33	4.58	4.83	5.07	5.32
11	3.85	4.12	4.38	4.66	4.93	5.20	5.47	5.74
12	4.11	4.40	4.70	4.99	5.28	5.58	5.87	6.16
13	4.37	4.68	5.00	5.32	5.63	5.95	6.26	6.58
14	4.63	4.97	5.30	5.64	5.99	6.32	6.66	7.00
15	4.89	5.25	5.62	5.97	6.33	6.70	7.05	7.42
16	5.16	5.54	5.92	6.30	6.68	7.07	7.45	7.83
17	5.42	5.82	6.22	6.63	7.03	7.43	7.83	8.24
18	5.67	6.09	6.52	6.95	7.37	7.79	8.22	8.64
19	5.93	6.38	6.82	7.27	7.71	8.16	8.61	9.05
20	6.18	6.65	7.12	7.58	8.05	8.52	8.98	9.46
21	6.44	6.92	7.42	7.91	8.39	8.88	9.37	9.86
22	6.70	7.20	7.71	8.21	8.72	9.23	9.74	10.25
23	6.95	7.47	8.00	8.53	9.05	9.59	10.12	10.64
24	7.20	7.74	8.29	8.84	9.38	9.94	10.48	11.03
25	7.44	8.01	8.57	9.14	9.71	10.28	10.85	11.41
26	7.68	8.28	8.86	9.45	10.04	10.63	11.21	11.80
27	7.93	8.54	9.14	9.75	10.36	10.96	11.57	12.18
28	8.17	8.79	9.43	10.05	10.68	11.30	11.93	12.55
29	8.41	9.05	9.70	10.35	10.99	11.63	12.28	12.93
30	8.65	9.31	9.97	10.64	11.30	11.96	12.63	13.29
31	8.88	9.56	10.25	10.93	11.62	12.29	12.97	13.66
32	9.12	9.82	10.52	11.22	11.92	12.62	13.32	14.02
33	9.35	10.07	10.79	11.51	12.22	12.95	13.66	14.38
34	9.58	10.32	11.05	11.79	12.53	13.27	14.00	14.73
35	9.81	10.56	11.31	12.07	12.82	13.58	14.34	15.09
36	10.04	10.80	11.58	12.35	13.12	13.89	14.66	15.44
37	10.26	11.05	11.84	12.63	13.41	14.21	14.99	15.79
38	10.48	11.29	12.10	12.90	13.71	14.52	15.32	16.13
39	10.70	11.53	12.35	13.17	13.99	14.82	15.64	16.46
40	10.92	11.76	12.60	13.44	14.28	15.12	15.96	16.80
41	11.13	11.99	12.85	13.71	14.56	15.42	16.28	17.14
42	11.35	12.22	13.10	13.97	14.85	15.72	16.59	17.46
43	11.56	12.46	13.35	14.23	15.13	16.02	16.91	17.80
44	11.78	12.68	13.59	14.49	15.40	16.30	17.21	18.11
45	11.98	12.90	13.83	14.75	15.67	16.59	17.52	18.44
46	12.19	13.13	14.06	15.01	15.95	16.88	17.82	18.75
47	12.39	13.35	14.30	15.26	16.21	17.16	18.12	19.07
48	12.60	13.57	14.54	15.51	16.48	17.45	18.41	19.39
49	12.80	13.79	14.77	15.76	16.74	17.73	18.71	19.70

Table 4. (continued) Average heights in metres of dominant and codominant white spruce by breast height age and site

Breast height age (Years)	Site Index						
	6	7	8	9	10	11	12
50	6.00	7.00	8.01	9.01	10.01	11.01	12.01
51	6.09	7.11	8.13	9.14	10.15	11.17	12.19
52	6.18	7.21	8.24	9.28	10.30	11.34	12.37
53	6.28	7.33	8.37	9.41	10.46	11.51	12.55
54	6.37	7.43	8.48	9.54	10.61	11.66	12.72
55	6.46	7.53	8.61	9.68	10.76	11.83	12.90
56	6.54	7.63	8.72	9.81	10.90	11.99	13.08
57	6.63	7.74	8.84	9.95	11.04	12.15	13.26
58	6.72	7.84	8.96	10.07	11.19	12.31	13.43
59	6.81	7.94	9.07	10.21	11.34	12.46	13.60
60	6.89	8.04	9.19	10.33	11.47	12.62	13.77
61	6.98	8.14	9.30	10.46	11.62	12.78	13.94
62	7.07	8.24	9.41	10.59	11.76	12.93	14.10
63	7.15	8.34	9.52	10.71	11.89	13.08	14.27
64	7.24	8.44	9.63	10.83	12.03	13.23	14.43
65	7.32	8.53	9.74	10.96	12.17	13.38	14.60
66	7.40	8.63	9.85	11.07	12.30	13.53	14.76
67	7.48	8.72	9.96	11.20	12.44	13.68	14.91
68	7.56	8.81	10.06	11.32	12.57	13.82	15.07
69	7.64	8.90	10.17	11.44	12.70	13.96	15.23
70	7.72	9.00	10.28	11.55	12.83	14.11	15.39
71	7.80	9.09	10.38	11.67	12.96	14.25	15.54
72	7.88	9.18	10.48	11.79	13.09	14.39	15.70
73	7.96	9.27	10.59	11.90	13.22	14.54	15.85
74	8.04	9.36	10.69	12.02	13.35	14.67	16.00
75	8.11	9.45	10.79	12.13	13.47	14.81	16.15
76	8.19	9.54	10.89	12.24	13.60	14.95	16.30
77	8.27	9.63	10.99	12.36	13.72	15.08	16.45
78	8.34	9.71	11.09	12.46	13.84	15.21	16.59
79	8.41	9.80	11.19	12.57	13.96	15.35	16.73
80	8.48	9.88	11.29	12.69	14.09	15.48	16.88
81	8.56	9.97	11.38	12.79	14.21	15.62	17.02
82	8.63	10.05	11.47	12.90	14.32	15.74	17.16
83	8.71	10.14	11.57	13.01	14.44	15.88	17.30
84	8.78	10.22	11.66	13.11	14.55	16.00	17.45
85	8.85	10.30	11.76	13.21	14.67	16.13	17.59
86	8.92	10.38	11.86	13.32	14.79	16.25	17.72
87	8.99	10.46	11.95	13.43	14.90	16.38	17.86
88	9.06	10.54	12.04	13.53	15.02	16.50	18.00
89	9.13	10.63	12.13	13.63	15.13	16.63	18.13
90	9.20	10.71	12.21	13.73	15.24	16.75	18.26
91	9.27	10.79	12.30	13.83	15.35	16.87	18.39
92	9.33	10.87	12.39	13.93	15.46	16.99	18.52
93	9.40	10.94	12.48	14.03	15.57	17.11	18.66
94	9.46	11.02	12.57	14.13	15.68	17.23	18.79
95	9.53	11.10	12.66	14.22	15.79	17.35	18.91
96	9.60	11.17	12.74	14.32	15.89	17.46	19.04
97	9.66	11.24	12.83	14.41	15.99	17.58	19.16
98	9.72	11.32	12.91	14.51	16.10	17.70	19.29
99	9.79	11.39	13.00	14.61	16.20	17.81	19.41

Table 4. (continued) Average heights in metres of dominant and codominant white spruce by breast height age and site

Breast height age (Years)	Site Index 13	14	15	16	17	18	19	20
50	13.01	14.01	15.01	16.00	17.00	18.00	19.00	20.00
51	13.20	14.21	15.23	16.25	17.26	18.27	19.29	20.30
52	13.40	14.43	15.46	16.49	17.52	18.55	19.58	20.61
53	13.60	14.64	15.69	16.73	17.77	18.82	19.86	20.91
54	13.79	14.85	15.90	16.96	18.02	19.09	20.14	21.20
55	13.98	15.05	16.13	17.20	18.27	19.35	20.43	21.50
56	14.17	15.26	16.34	17.43	18.52	19.61	20.70	21.79
57	14.36	15.46	16.56	17.66	18.77	19.87	20.98	22.07
58	14.54	15.66	16.77	17.89	19.01	20.13	21.25	22.36
59	14.73	15.86	16.99	18.12	19.25	20.39	21.52	22.64
60	14.91	16.05	17.20	18.34	19.50	20.64	21.79	22.93
61	15.10	16.25	17.41	18.57	19.73	20.89	22.05	23.20
62	15.28	16.45	17.62	18.79	19.96	21.14	22.31	23.48
63	15.46	16.64	17.82	19.01	20.20	21.39	22.57	23.75
64	15.63	16.83	18.03	19.23	20.43	21.63	22.83	24.03
65	15.80	17.02	18.23	19.45	20.66	21.87	23.09	24.30
66	15.98	17.21	18.43	19.66	20.89	22.11	23.34	24.57
67	16.16	17.39	18.64	19.87	21.11	22.35	23.59	24.83
68	16.32	17.58	18.83	20.09	21.34	22.59	23.84	25.09
69	16.50	17.76	19.02	20.29	21.55	22.82	24.09	25.35
70	16.66	17.95	19.22	20.50	21.77	23.05	24.33	25.61
71	16.84	18.13	19.41	20.70	22.00	23.29	24.57	25.86
72	17.00	18.30	19.61	20.91	22.21	23.52	24.82	26.12
73	17.16	18.48	19.80	21.11	22.43	23.74	25.05	26.37
74	17.32	18.66	19.98	21.31	22.64	23.96	25.30	26.62
75	17.49	18.83	20.17	21.51	22.85	24.19	25.53	26.86
76	17.65	19.00	20.36	21.70	23.05	24.41	25.76	27.11
77	17.81	19.18	20.54	21.90	23.27	24.63	25.99	27.36
78	17.97	19.34	20.72	22.09	23.47	24.84	26.22	27.60
79	18.13	19.51	20.90	22.29	23.68	25.06	26.45	27.84
80	18.28	19.68	21.08	22.48	23.88	25.27	26.68	28.07
81	18.43	19.84	21.25	22.66	24.08	25.49	26.90	28.31
82	18.59	20.01	21.43	22.86	24.27	25.70	27.12	28.55
83	18.74	20.18	21.61	23.04	24.48	25.91	27.34	28.77
84	18.89	20.34	21.78	23.23	24.67	26.11	27.56	29.00
85	19.04	20.50	21.95	23.41	24.86	26.32	27.77	29.23
86	19.19	20.66	22.13	23.59	25.06	26.52	28.00	29.46
87	19.34	20.82	22.30	23.77	25.25	26.73	28.20	29.68
88	19.48	20.97	22.46	23.95	25.44	26.93	28.42	29.91
89	19.63	21.13	22.63	24.13	25.63	27.13	28.63	30.13
90	19.77	21.28	22.80	24.30	25.82	27.32	28.84	30.34
91	19.91	21.43	22.95	24.48	26.00	27.52	29.05	30.57
92	20.05	21.59	23.12	24.65	26.18	27.71	29.25	30.78
93	20.20	21.74	23.28	24.82	26.36	27.91	29.45	31.00
94	20.34	21.89	23.44	25.00	26.55	28.10	29.66	31.20
95	20.48	22.04	23.60	25.16	26.73	28.29	29.86	31.42
96	20.61	22.18	23.76	25.34	26.91	28.48	30.05	31.63
97	20.75	22.34	23.91	25.50	27.09	28.67	30.25	31.84
98	20.89	22.48	24.07	25.66	27.26	28.86	30.45	32.04
99	21.02	22.62	24.23	25.83	27.43	29.04	30.64	32.24

Table 4. (continued) Average heights in metres of dominant and codominant white spruce by breast height age and site

Breast height age (Years)	Site Index 6	7	8	9	10	11	12
100	9.86	11.47	13.09	14.70	16.31	17.93	19.54
101	9.92	11.54	13.16	14.79	16.41	18.04	19.66
102	9.98	11.62	13.25	14.88	16.52	18.15	19.78
103	10.04	11.69	13.33	14.97	16.61	18.26	19.91
104	10.11	11.76	13.41	15.06	16.71	18.37	20.02
105	10.16	11.83	13.49	15.15	16.82	18.48	20.14
106	10.23	11.90	13.57	15.24	16.91	18.59	20.26
107	10.29	11.97	13.65	15.34	17.02	18.70	20.38
108	10.35	12.04	13.73	15.42	17.11	18.80	20.50
109	10.41	12.11	13.81	15.51	17.21	18.91	20.61
110	10.47	12.18	13.88	15.60	17.30	19.02	20.73
111	10.53	12.24	13.96	15.69	17.40	19.12	20.84
112	10.59	12.31	14.04	15.77	17.50	19.23	20.95
113	10.64	12.38	14.12	15.86	17.59	19.32	21.07
114	10.70	12.45	14.20	15.94	17.68	19.43	21.18
115	10.76	12.52	14.27	16.02	17.77	19.53	21.29
116	10.81	12.58	14.35	16.11	17.87	19.63	21.39
117	10.88	12.64	14.41	16.19	17.96	19.73	21.50
118	10.93	12.71	14.49	16.27	18.05	19.83	21.61
119	10.98	12.78	14.56	16.36	18.14	19.93	21.72
120	11.04	12.84	14.63	16.43	18.23	20.03	21.82
121	11.10	12.90	14.71	16.52	18.32	20.13	21.93
122	11.15	12.96	14.78	16.59	18.41	20.23	22.04
123	11.21	13.03	14.85	16.68	18.50	20.32	22.14
124	11.26	13.09	14.92	16.75	18.59	20.41	22.25
125	11.31	13.15	14.99	16.83	18.67	20.51	22.35
126	11.37	13.21	15.06	16.91	18.76	20.61	22.45
127	11.42	13.28	15.13	16.98	18.84	20.70	22.55
128	11.47	13.34	15.20	17.07	18.93	20.79	22.66
129	11.53	13.39	15.27	17.14	19.01	20.89	22.75
130	11.57	13.46	15.34	17.21	19.09	20.98	22.86
131	11.63	13.52	15.40	17.29	19.18	21.07	22.95
132	11.68	13.57	15.47	17.36	19.26	21.16	23.05
133	11.73	13.63	15.54	17.44	19.34	21.25	23.15
134	11.78	13.69	15.61	17.52	19.43	21.34	23.25
135	11.83	13.75	15.67	17.59	19.50	21.43	23.34
136	11.88	13.80	15.73	17.66	19.59	21.52	23.44
137	11.93	13.87	15.80	17.73	19.67	21.60	23.54
138	11.98	13.92	15.87	17.80	19.75	21.69	23.63
139	12.03	13.97	15.93	17.88	19.82	21.77	23.73
140	12.07	14.04	15.99	17.95	19.91	21.86	23.82
141	12.13	14.09	16.05	18.02	19.98	21.95	23.91
142	12.18	14.14	16.11	18.09	20.06	22.03	24.00
143	12.22	14.20	16.18	18.16	20.14	22.11	24.09
144	12.27	14.26	16.24	18.23	20.21	22.20	24.18
145	12.31	14.31	16.30	18.30	20.29	22.29	24.27
146	12.36	14.37	16.36	18.36	20.36	22.36	24.36
147	12.41	14.41	16.43	18.43	20.44	22.45	24.45
148	12.46	14.47	16.48	18.50	20.52	22.53	24.55
149	12.50	14.53	16.55	18.57	20.59	22.61	24.64
150	12.54	14.57	16.61	18.64	20.66	22.69	24.72

Table 4. (continued) Average heights in metres of dominant and codominant white spruce by breast height age and site

Breast height age (Years)	Site Index 13	14	15	16	17	18	19	20
100	21.15	22.77	24.38	26.00	27.61	29.22	30.84	32.45
101	21.29	22.91	24.53	26.16	27.78	29.41	31.02	32.65
102	21.41	23.05	24.68	26.32	27.95	29.59	31.21	32.85
103	21.55	23.19	24.84	26.48	28.12	29.76	31.41	33.05
104	21.68	23.33	24.98	26.64	28.29	29.94	31.59	33.24
105	21.80	23.46	25.13	26.79	28.45	30.11	31.78	33.44
106	21.93	23.61	25.27	26.95	28.62	30.29	31.96	33.63
107	22.06	23.74	25.42	27.11	28.79	30.46	32.15	33.83
108	22.18	23.88	25.57	27.25	28.95	30.64	32.33	34.02
109	22.31	24.01	25.71	27.41	29.11	30.81	32.51	34.21
110	22.43	24.14	25.85	27.56	29.27	30.98	32.69	34.40
111	22.55	24.27	26.00	27.71	29.43	31.15	32.87	34.59
112	22.68	24.41	26.14	27.86	29.59	31.32	33.05	34.77
113	22.80	24.54	26.27	28.01	29.75	31.48	33.22	34.95
114	22.92	24.66	26.41	28.16	29.90	31.64	33.40	35.14
115	23.04	24.80	26.55	28.30	30.05	31.81	33.56	35.32
116	23.16	24.92	26.68	28.45	30.21	31.98	33.73	35.50
117	23.27	25.05	26.82	28.59	30.36	32.13	33.91	35.68
118	23.39	25.18	26.95	28.73	30.52	32.30	34.08	35.86
119	23.51	25.30	27.09	28.88	30.66	32.45	34.24	36.03
120	23.63	25.43	27.22	29.02	30.82	32.62	34.41	36.21
121	23.74	25.55	27.35	29.16	30.96	32.77	34.58	36.38
122	23.86	25.67	27.48	29.30	31.11	32.92	34.74	36.55
123	23.96	25.79	27.61	29.43	31.26	33.08	34.91	36.73
124	24.08	25.91	27.74	29.57	31.41	33.23	35.07	36.90
125	24.19	26.03	27.87	29.71	31.55	33.39	35.23	37.07
126	24.30	26.15	28.00	29.84	31.70	33.54	35.39	37.23
127	24.41	26.27	28.13	29.98	31.84	33.69	35.55	37.41
128	24.52	26.39	28.25	30.11	31.98	33.84	35.70	37.57
129	24.63	26.50	28.38	30.25	32.12	33.99	35.87	37.73
130	24.73	26.61	28.50	30.38	32.26	34.14	36.02	37.90
131	24.84	26.73	28.62	30.51	32.40	34.28	36.17	38.06
132	24.95	26.84	28.74	30.64	32.53	34.43	36.33	38.23
133	25.05	26.96	28.86	30.77	32.67	34.58	36.48	38.38
134	25.16	27.07	28.98	30.89	32.80	34.72	36.63	38.54
135	25.27	27.18	29.11	31.02	32.95	34.86	36.78	38.70
136	25.37	27.30	29.23	31.15	33.08	35.01	36.93	38.86
137	25.47	27.41	29.34	31.27	33.21	35.15	37.08	39.02
138	25.57	27.52	29.46	31.40	33.34	35.28	37.23	39.17
139	25.68	27.63	29.57	31.52	33.48	35.42	37.38	39.33
140	25.77	27.73	29.69	31.65	33.60	35.56	37.52	39.48
141	25.88	27.84	29.80	31.77	33.73	35.70	37.66	39.63
142	25.98	27.95	29.92	31.89	33.87	35.84	37.80	39.78
143	26.07	28.05	30.04	32.02	33.99	35.97	37.95	39.93
144	26.18	28.16	30.14	32.13	34.12	36.10	38.09	40.08
145	26.27	28.27	30.26	32.25	34.24	36.24	38.23	40.23
146	26.37	28.37	30.37	32.37	34.37	36.37	38.38	40.38
147	26.46	28.47	30.48	32.49	34.49	36.51	38.51	40.52
148	26.56	28.57	30.59	32.60	34.62	36.63	38.65	40.66
149	26.66	28.68	30.70	32.72	34.74	36.77	38.79	40.81
150	26.75	28.78	30.81	32.84	34.87	36.90	38.92	40.95

APPENDIX

Ecoregions of the Yukon Territory